
Space Weather Technical Forecast

Issued on Thursday, 24 February 2022 at 13:08 Local

This technical forecast provides a four day assessment of space weather events. The probabilities stated below are for reaching or exceeding the given levels. For more information about space weather impacts please see the Met Office Space Weather Scales <https://www.metoffice.gov.uk/weather/learn-about/space-weather/uk-scales>

Space Weather Forecast Headline: No significant activity**Analysis of Space Weather Activity over past 24 hours**

Solar Activity: Solar activity has been very low over the last 24 hours, with one B9.3 flare observed from AR2955 Cso/Beta. This is one of two mature sunspots on the disc, along with stable spot AR2954 Hsx/alpha, both in the northwest quadrant. No Earth-directed CMEs were observed in the available imagery during the past 24 hours.

Solar Wind / Geomagnetic Activity: The solar wind, as measured by DSCOVR at L1, has been slightly elevated to elevated, declining to 420km/s, before rising to peak 540 km/s around 24/0500 UTC, due to a mixture of waning fast wind influence and perhaps a weak passing transient. Speeds have subsequently declined to near 450 km/s. Density has been around average for much the period, but above average alongside the elevated solar winds. Total magnetic field strength (IMF), Bt has been weak at 4-6nT, with the north-south component, Bz, predominately negative (southward) at first, before rotating to be mostly positive from 24/0800 UTC, ranging -4 to +4 nT. The phi angle has been mainly positive (away from the Sun), with brief rotations into the negative orientation. Resultant geomagnetic activity was Quiet (Kp 0-2).

Energetic Particles / Solar Radiation: The high energy proton flux (10MeV) measured at GOES 16 was at background levels. The high energy electron flux (greater than 2MeV) has been at normal background to moderate levels. The corresponding 24-hour integrated electron fluence is below the Active (1e8 integrated pfu) threshold with the 24/0000 UTC observation 1.26e7 integrated pfu.

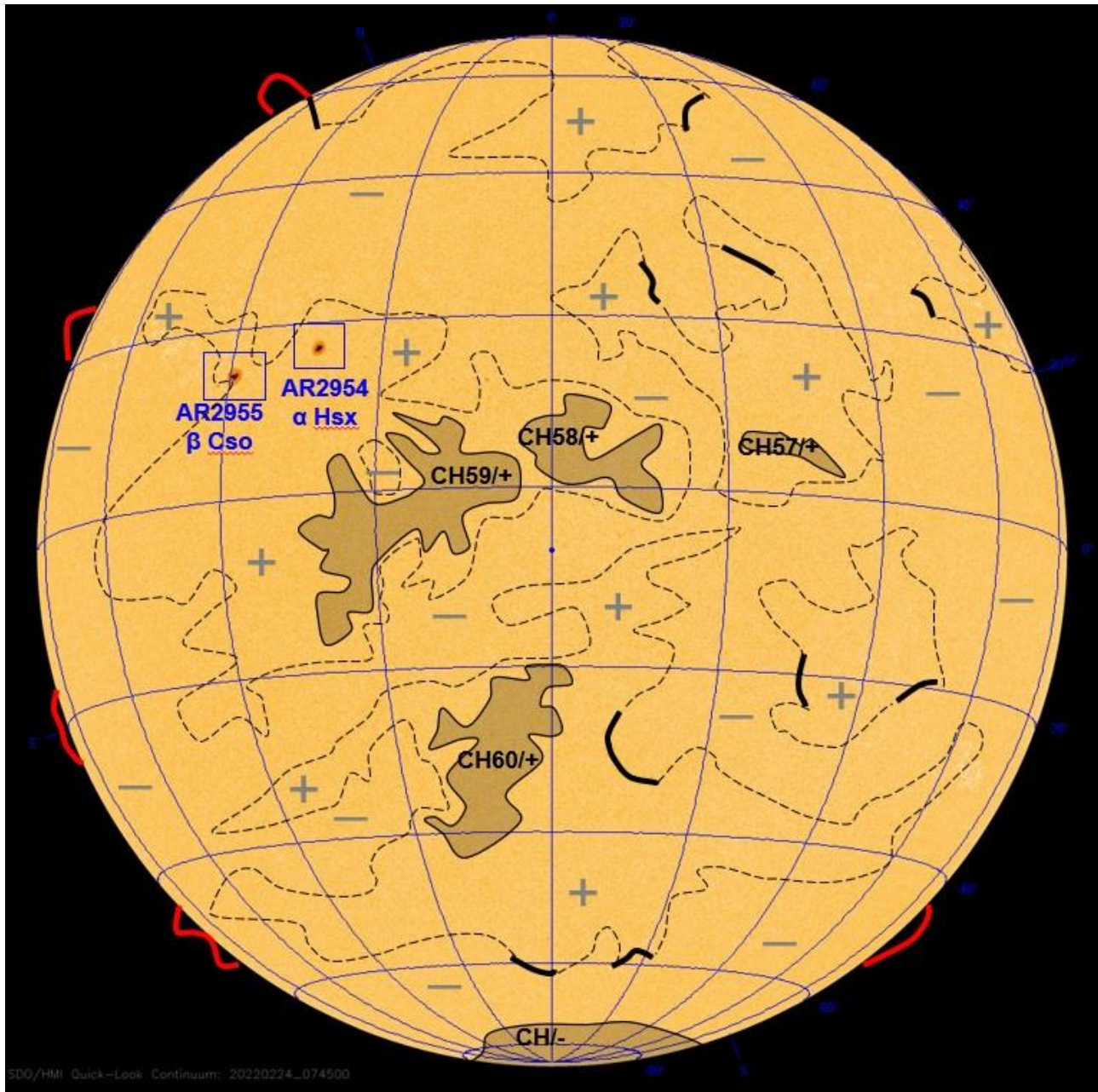
Four-Day Space Weather Forecast Summary

Solar Activity: Solar activity is forecast to be Very Low, with a chance of rising to Low, and only a very slight chance of M-class flares, predominately from AR2955.

Solar Wind / Geomagnetic Activity: There are no Earth-directed CMEs. Further coronal hole fast wind arrivals through the period will bring slightly elevated to elevated solar winds throughout. Geomagnetic activity is expected to be generally Quiet with isolated Unsettled spells, but with a chance of Active and a very slight chance G1/Minor Storms, mainly day 3 and day 4 (26th and 27th).

Energetic Particles / Solar Radiation: The high energy (greater than 10 MeV) proton flux is expected to remain at background levels. The high energy electron flux (greater than 2MeV) is expected to erratically rise through the period, likely persisting to more persistent Moderate levels, but perhaps increasing to High at diurnal peak by the end of the period. The associated 24 hour fluence is forecast to stay below the Active (1e8 integrated pfu) threshold but with a very slight chance of rising above by the end of the period

Figure 1. Solar Analysis Valid 24/0800 UTC.



Key: Filament ___, Prominence ___, Magnetic Field Line - - -, Polarity +/-, Coronal Holes: Grey shaded area CHxx +/-, Sunspot groups 25xx - Mt Wilson α - β - $\beta\gamma$ - $\beta\gamma\delta$ and Zurich-McIntosh Axx etc.

Geomagnetic Storms:

There are no Earth-directed CMEs. Solar winds are currently slightly elevated after recent fast wind enhancements and a passing transient feature. A number of coronal hole features, have the potential to bring further fast wind enhancements through the period.

CH57/+ is the most western feature, with associated fast winds likely to arrive either late day 1 (24th) or during day 2 (25th), but likely to give only slight enhancements. CH58/+ fast winds follows, day 3 (26th), before what appears to be the most coherent feature CH59/+, whose fast winds are likely to arrive day 4 (27th). Overall, these will bring an extended period of elevated to slightly elevated solar winds, with transitions between each of the regimes being hard to assess. There is also some uncertainty with the timings, along with the polarity of the associated fields, with some sector boundary crossings possible through the period.

Overall, mainly Quiet geomagnetic conditions are expected, with isolated Unsettled intervals. However periods of Active are possible, most likely day 3 or day 4 (26th and 27th), when there will be a very slight chance of G1/Minor Storm intervals.

Geo-Magnetic Storm	Level	Past 24 Hours (Yes/No)	Day 1 (00-24 UTC)	Day 2 (00-24 UTC)	Day 3 (00-24 UTC)	Day 4 (00-24 UTC)
Probability (Exceedance)			(%)	(%)	(%)	(%)
Minor or Moderate	G1 to G2	No	1	5	10	10
Strong	G3	No	1	1	1	1
Severe	G4	No	1	1	1	1
Extreme	G5	No	1	1	1	1

Figure 2: Solar Wind persistence Model Slightly elevated to elevated winds indicated.

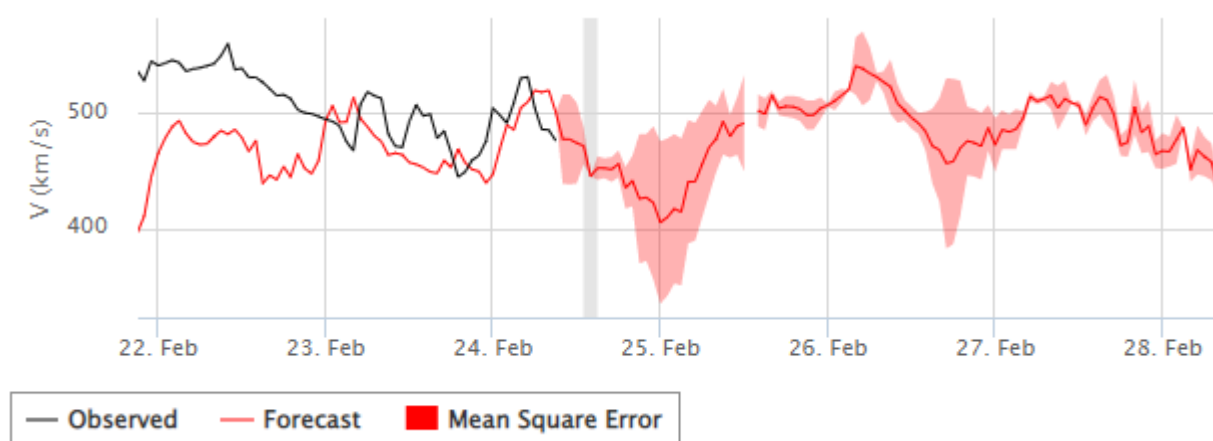


Figure 3: Enlil No CMEs, however slightly elevated to elevated winds throughout.

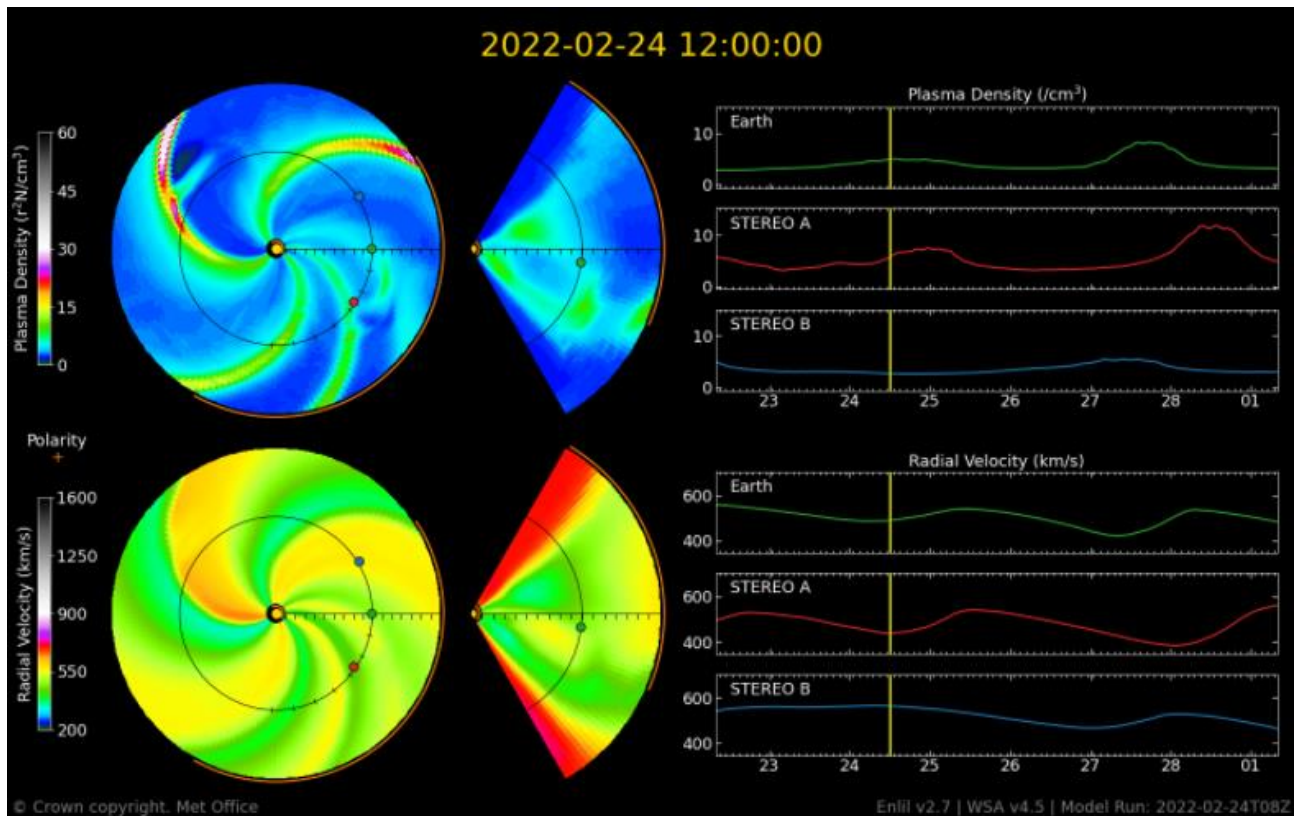
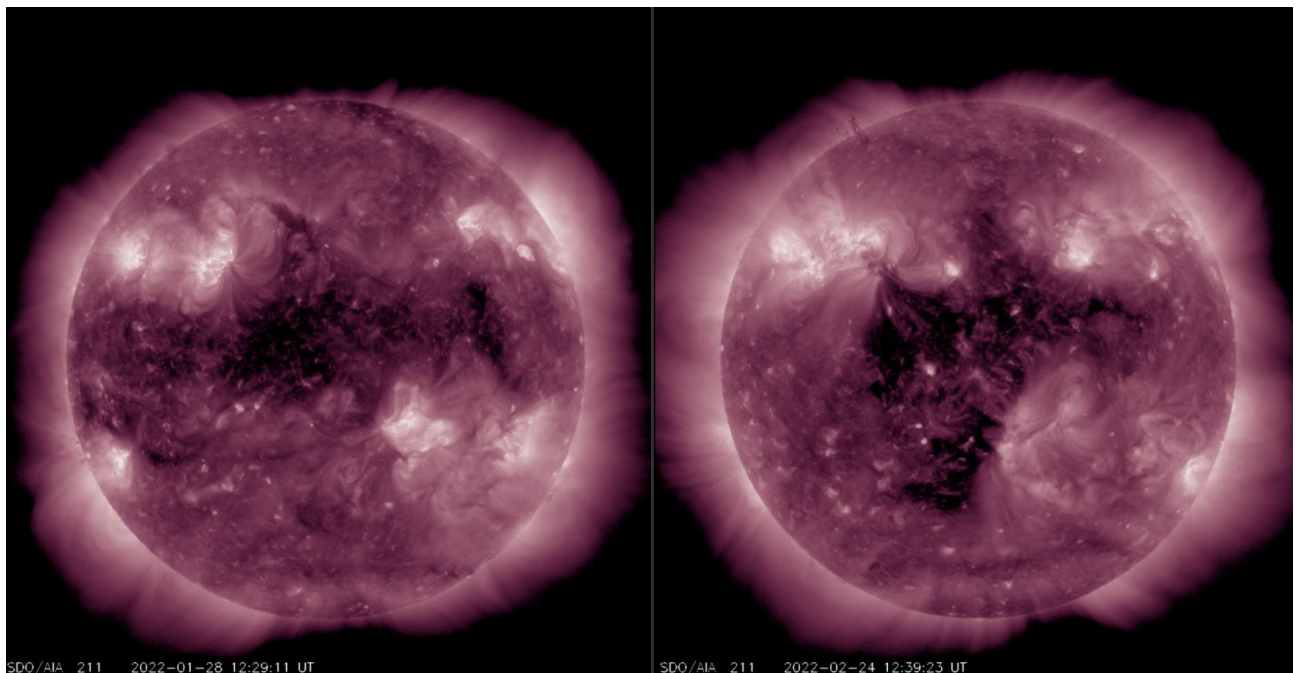


Figure 4: SDO aia 211 of last (left) rotation and current rotation (right) Similar CH and weak fields, supporting persistence of slightly elevated to elevated winds throughout.

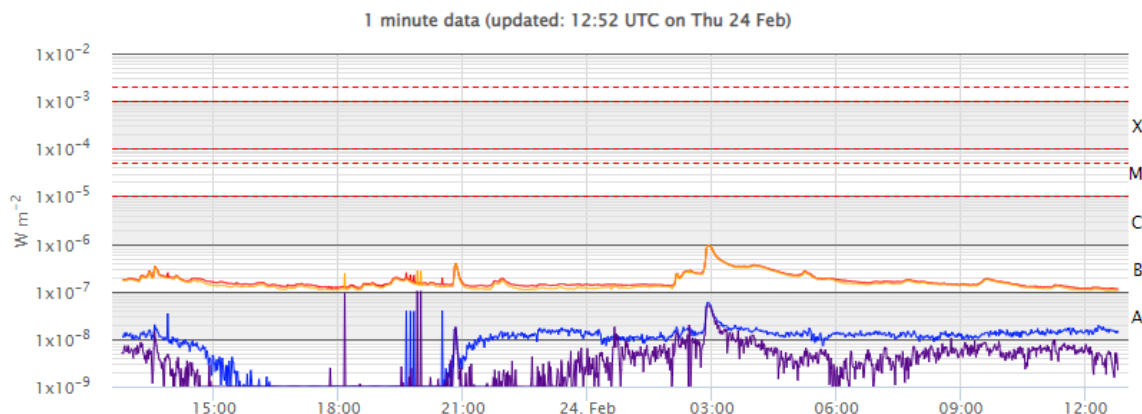


Radio Blackouts - X-Ray Flares:

Solar activity is Very Low There are two sunspot regions on the visible disc, both of which are mature features. AR2955 Cso/beta is the most likely for further flaring, with some slow and transient trailer development, and having already produced a B9.3 in the last 24 hours. AR2956 is currently a small and simple Hsx/alpha spot.

X Ray Flares	Level	Past 24 Hours (Yes/No)	Day 1 (00-24 UTC)	Day 2 (00-24 UTC)	Day 3 (00-24 UTC)	Day 4 (00-24 UTC)
Probability			(%)	(%)	(%)	(%)
Active	R1-R2 M Class	No	5	5	5	5
Very Active	R3 to R5 X Class	No	1	1	1	1

Figure 5: GOES-16/17 X-ray Flux



Solar Radiation Storms - (High Energy Protons):

The high energy proton flux (10MeV) measured at GOES 16 is at background levels, and expected to remain at this level with no solar radiation storms occurring.

Radiation Storms	Level ($\text{cm}^{-2} \text{sr}^{-1} \text{s}^{-1}$)	Past 24 Hours (Yes/No)	Day 1 (00-24 UTC)	Day 2 (00-24 UTC)	Day 3 (00-24 UTC)	Day 4 (00-24 UTC)
Probability (Exceedance)			(%)	(%)	(%)	(%)
Active	$\geq \text{S1}$	No	1	1	1	1
Very Active	$\geq \text{S3}$ *	No	1	1	1	1

* $\text{S3} \geq 10 \text{ MeV} \geq 1000 \text{ pfu}$ and / or $\geq 50 \text{ MeV} \geq 10 \text{ pfu}$. (pfu = $\text{cm}^{-2} \text{sr}^{-1} \text{s}^{-1}$)



High Energy Electrons Event ($\geq 2\text{MeV}$):

High energy electron flux (greater than 2MeV) as observed by GOES-16 has been varying between background and moderate levels, with recent fast wind enhancements leading to a diurnal oscillation between background and moderate levels. Ongoing fast wind enhancements from the numerous coronal holes on the Earth-facing disc are likely to increase electron populations through the period, with potentially high levels developing at diurnal peak at GEO (greater than 1000pfu) by day 3.

The associated fluence is expected to rise due to the ongoing enhancement, but likely staying below the Active threshold, and noticeably lower than REFM indicates beyond T+24. REFM is giving good guidance during the first 24 hours.

GEO Electron Environment	Level ($\text{cm}^{-2} \text{sr}^{-1} \text{day}^{-1}$)	Past 24 Hours (Yes/No)	Day 1 (00-24 UTC)	Day 2 (00-24 UTC)	Day 3 (00-24 UTC)	Day 4 (00-24 UTC)
Probability (Exceedance)			(%)	(%)	(%)	(%)
Active	$\geq 2 \text{ MeV}$ $\geq 1 \times 10^8$	No	1	10	20	20
Very Active	$\geq 2 \text{ MeV}$ $\geq 1 \times 10^9$	No	1	1	1	1

Figure 6: GOES-16 $>2\text{MeV}$ Electron Flux (top), and Fluence with REFM (bottom)

